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(54) Title of the invention:

Data format converting apparatus

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Specification

1. Title of the invention:

   Data format converting apparatus

2. Claim

(1) A data format converting apparatus that receives data from an information processing apparatus employing one data format, and having a microprocessor, a main storage device, and a cache memory inserted between them, converts the one data format into another data format, which is employed in another information processing apparatus, and outputs it, comprising:

   a data format converting means for converting data described by one data format into another data format and outputting the data; and

   a transferring means for transferring the data to the data format converting means as soon as the microprocessor takes out the data from the cache memory.

3. Detailed description of the invention

[Summary]

   A data format converting apparatus, which converts a data format of data in an information processing apparatus having a cache memory, comprises: a data format converting means for converting data from one data format into

another data format and outputting the data; and a transferring means for transferring the data to the data format converting means as soon as the microprocessor of the information processing apparatus takes out the data from the cache memory, thereby enabling to convert data format in a short time.

[Industrial field of application]

The present invention relates to a converting method of data format, and especially, to a data format converting apparatus that converts the data format, when the data is transferred from one information processing apparatus, which has a cache memory between a microprocessor and a storage unit, to the other information processing apparatus employing a data format different from the one information processing apparatus.

[Prior art]

Generally, data are described in a certain format, but there are some cases where the data are transferred from an information processing apparatus employing a certain data format to the other information processing apparatus employing a different data format, or transferred with each other between them. For an example of such a case, there is a case where an image data is

transferred from a workstation using IEEE data format to a host computer employing a different data format, and the image data is processed and transferred again back to the workstation for display. In this case, when the data is transferred between those two information processing apparatuses, the data format is converted into formats adaptable for respective apparatuses.

Conventionally, such a data format conversion has been executed by processing on a predetermined software.

[Problems that the invention is to solve]

In this connection, there is a problem, in the data format conversion by means of software as described above, that it takes too much time for converting the data format of above-mentioned image data, because of a limit of processing rate, therefore it is of no practical use.

[Means for solving the problems]

In the present invention, means for solving the above-described problem is, referring to Fig. 1, a data format converting apparatus 5 that receives data from an information processing apparatus 4 employing one data format, and having a microprocessor (MPU) 1, a main storage device 2, and a cache memory 3 inserted between them, converts the one data format into another data

format, which is employed in another information processing apparatus 8, and outputs it. The data format converting processing apparatus 4 comprises: a data format converting means 6 for converting data described by one data format into another data format and outputting the data; and a transferring means for transferring the data to the data format converting means as soon as the microprocessor 1 of the one information processing apparatus 4 takes out the data from the cache memory 3.

[Operation]

According to the present invention, since the conversion of data format is executed with a hardware, it can be rapidly performed. Furthermore, the data transfer within the information processing apparatus is performed concurrently with the conversion, therefore the processing time can be reduced.

[Example]

Hereinafter, an example of the data format converting apparatus according to the present invention will be described based on the drawings.

Figs. 2-4 are showing an example of a data format converting apparatus according to the present invention. In the example, a data format converting apparatus

converts and transfers a data format of image data of one information processing apparatus 11 to another information processing apparatus 12, which works as a coordinate transforming device and employs another data format. Further in this example, as shown in Fig. 2, the information processing apparatus 11 is composed of a microprocessor (MPU) 13, a main storage device 14 that stores image data, and a cache memory 15 disposed between the main storage device 14 and the microprocessor. A data format converting apparatus 16 is connected to a data bus 17, which connects the microprocessor 13, the main storage device 14 and the cache memory 15 of the information processing apparatus 11 together. The microprocessor 13 further outputs a function code for indicating that the information read out from the main storage device 14 is program or data.

This data format converting apparatus 16 is composed of a data format converting means that executed the conversion between the data format, which is employed by the information processing apparatus 11, and the data format, which is employed by the coordinate transforming device 12, and a controlling means including a transferring means that transfers data to the data format converting means as soon as the MPU of the workstation takes out the data from the cache memory. This controlling

means further has, besides the above-described function as a transferring means, a function that receives the above-mentioned function code outputted by the microprocessor via a decoder and accepts only when the information is data, and the other control functions such as designating of conversion form, selecting fineness of input/output data, allowing interruption when a conversion error occurred or not, etc.

Next, the operation of a data format converting apparatus according to the present example will be described. Fig. 3 shows data flows at respective parts in the present example, while Fig. 4 is a time chart showing those data flows. Here, the apparatus is now in the state the microprocessor 13 has already called image information from the main storage device 14 to the cache memory 15. In this state, the microprocessor 13 specifies addresses of image information to be called from the image information which have been already stored in the cache memory 15 (A(1)). Then, the cache memory 15 outputs the image information of a predetermined address onto the data bus 17. At that time, the microprocessor 13 receives the information and, simultaneously with that, the controlling unit of the data format converting apparatus 16 refers to the function code of the microprocessor 13 to confirm that the information is data, before accepting the data (D(1),

t_1). Then, the data format is converted.

Next, for the purpose of taking out the format-converted data, the microprocessor 13 feeds an address-specifying signal to the data format converting apparatus 16 (A(2)). Then, the data format converting apparatus 16 outputs the image information, in which the data format has been converted into the data format employed by the coordinate transforming device 12, onto the data bus 17, so that the microprocessor 13 reads it out (D(2), t_2). Then, the microprocessor 13 outputs the data-format converted data to the coordinate transforming device 12 (D(3), t_4).

And, the coordinate transforming device 12 execute the coordinate transformation of the received data.

Accordingly, in the present example, since the conversion of data format is performed by a hardware, instead of software processing, the processing rate of conversion can be raised to a higher rate.

Furthermore, the present example differs from the case the conventional microprocessor and conventional data format converting means are used to execute the data format conversion, in the following points, that is:

The conventional case would require four steps below:

(1) The microprocessor reads out needed data from the

cache memory.

(2) The microprocessor outputs the data from the data format converting apparatus to the data format converting apparatus.

(3) The microprocessor reads out the data-format converted data from the data format converting apparatus.

(4) The microprocessor outputs the data-format converted data to the coordinate transforming device.

While the present example performs those processes in three steps below:

(1) As soon as the microprocessor reads out data from the cache memory, the data format converting apparatus reads out the data.

(2) The microprocessor reads out the data-format converted data from the data format converting apparatus.

(3) The microprocessor outputs the data-format converted data to the coordinate transforming device.

Therefore the processing rate of conversion can be raised to a higher rate.

[Advantage of the invention]

As described heretofore, according to the present invention, since a data format converting apparatus, which converts a data format of data in an information processing apparatus having a cache memory, comprises: a

data format converting means for converting data from one data format into another data format and outputting the data; and a transferring means for transferring the data to the data format converting means as soon as the microprocessor of the information processing apparatus takes out the data from the cache memory, the conversion of data format can be performed by a hardware, instead of software processing, and the processing rate of conversion can be raised to a higher rate. Additionally, it has an advantage that, since the data transfer can be performed efficiently, the converting process can be performed further rapidly.

4. Brief description of the drawings

Fig. 1 is a diagram showing a structure of data format converting apparatus according to the present invention; Fig. 2 is a block diagram showing an example of data format converting apparatus according to the present invention; Fig. 3 is a diagram showing the data flows in the data format converting apparatus shown in Fig. 2; and Fig. 4 is a time chart showing the operations in the data format converting apparatus shown in Fig. 2.

1.....Microprocessor;

2.....Main storage device;

3.....Cache memory;

4, 8.....Information processing apparatus;

5.....Data format converting apparatus;

6.....Data format converting means; and

7.....Transferring means.

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(In the figures)

Fig. 1: Diagram showing a structure of the invention

    1: MPU

    2: Main storage device

    3: Cache memory

    4: Information processing apparatus

    5: Data format converting apparatus

    6: Data format converting means

    7: Transferring means

    8: Information processing apparatus.

Fig. 2: Example of the invention

    12: Coordinate transforming Device

    13: MPU

    14: Main storage device

    15: Cache memory

    16: Data format converting apparatus

    (13←→16): Decoder

Fig. 3: Diagram showing data flows in the example

    12: Coordinate transforming Device

    13: MPU

    14: Main storage device

    15: Cache memory

    16: Data format converting apparatus

Fig. 4: Time chart of the example

(t_1-): Format conversion

(t_0-t_1): Cache memory $\rightarrow$ MPU

$\rightarrow$ Converting apparatus

(t_1-t_2): Converting apparatus $\rightarrow$ MPU

(t_2-t_4): MPU $\rightarrow$ Coordinate transforming device

力するデータフォーマット変換手段と、一の情報
処理装置のマイクロプロセッサがキャッシュメモ
りからデータを取り出すと同時にデータフォー
マット変換装置にデータ転送する転送手段とを設
けるようにしたことにより、データフォーマット
の変換をソフトウエアによる演算ではなく、ハー
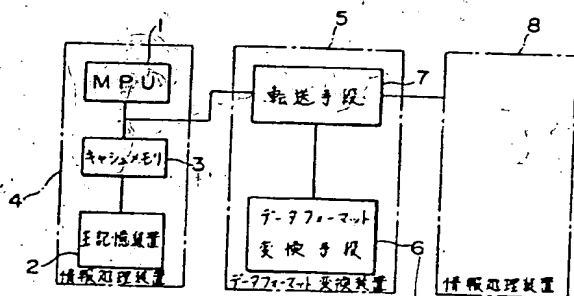ドウエアで実行し、変換処理を迅速なものとする
ことができる。また、データの転送を効率よく行
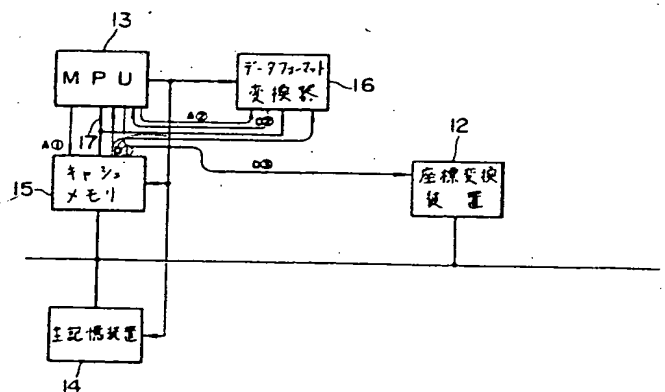なうことができるため更に変換処理を迅速に行な
うことができるという効果を奏する。

4．図面の簡単な説明

　第1図は本発明に係るデータフォーマット　変
換装置の構成を示す図、第2図は本発明に係る
データフォーマット変換装置の実施例を示すブ
ロック図、第3図は第2図に示したデータフォー
マット変換装置のデータの流れを示す図、第4図
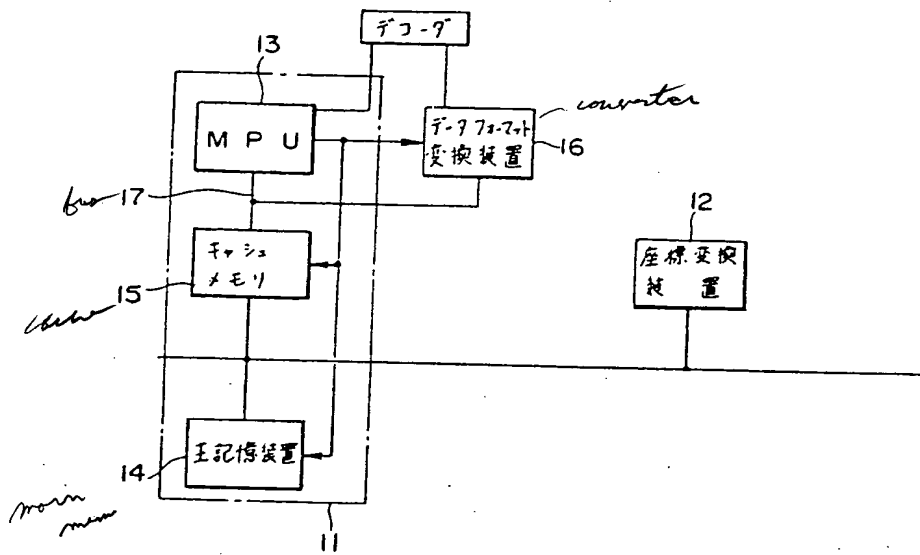は第2図に示したデータフォーマット変換装置の
作動を示すタイムチャートである。

　　1…マイクロプロセッサ

2…主記憶装置

3…キャッシュメモリ

4，8…情報処理装置

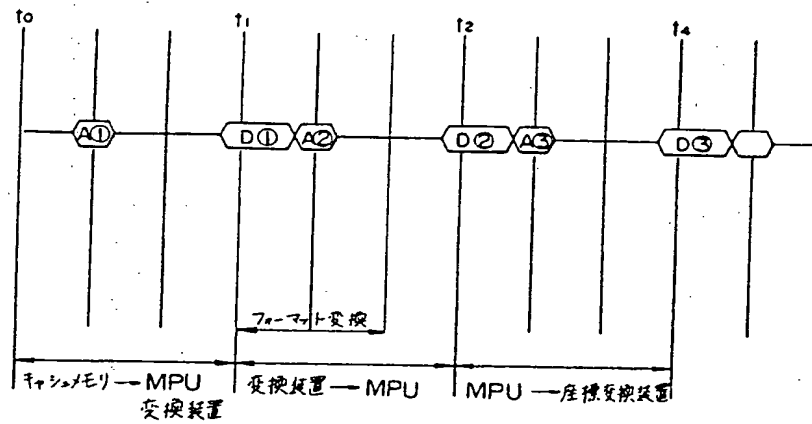5…データフォーマット変換装置

6…データフォーマット変換手段

7…転送手段

本発明の構成を示す図

第　1　図

実施例のデータの流れを示す図

第　3　図

本発明の実施例

第 2 図

実施例のタイムチャート

第 4 図